Name_____Period_____Date_____

GENETICS

I. GREGOR MENDEL – founder of genetics (crossed pea plants to study heredity = passing on of traits)

1. **GENES** – make up chromosomes
   a. 2 genes (ALLELES) for every trait (1 from each parent)
2. **DOMINANT GENE/TRAIT** – stronger gene – CAPITAL LETTER (T)
3. **RECESSIVE GENE/TRAIT** – weaker gene – lower case (t)
4. **PHENOTYPE** – physical appearance (what offspring look like)
5. **GENOTYPE** – genetic makeup

T = tall plant, t = short plant

GENES	PHENOTYPE	GENOTYPE
TT	**Tall**	**Homozygous OR pure dominant**
tt	**Short**	**Homozygous OR pure recessive**
Tt	**Tall**	**Heterozygous OR hybrid**

II. PUNNETT SQUARES

1. Cross a pure dominant tall plant with a hybrid plant.

	T	T
T	TT	TT
t	Tt	Tt

Phenotype = 100% tall

Genotype = 50% pure dominant, 50% hybrid

---

2. B = Brown eyes, b = blue eyes

Cross a blue eyed person with a hybrid brown eyed person. Give the phenotypes & genotypes of their offspring.

	b	b
B	Bb	Bb
b	bb	bb

Phenotype = 50% brown eyes, 50% blue eyes

Genotype = 50% hybrid, 50% pure recessive

III. CHROMOSOMES

1. **CHROMOSOMES** – rod shaped structures in the nucleus that control all cell activities & contain hereditary information
   a. CHROMOSOMES → made of GENES → made of DNA
2. **SEX CHROMOSOMES** – chromosomes that determine sex of organism
   EGGS = X SPERM = X or Y
   FEMALE = XX MALE = XY
3. **MUTATION** – change in a gene that may cause a new trait (good or bad)
   a. in body cells (example: skin cells) → cannot be passed on to offspring
   b. in SEX CELLS → can be passed on to offspring
   c. Examples: sickle cell anemia

IV. MULTILE ALLELES – MORE THAN 2 GENES AVAILABLE FOR A TRAIT

1. Example: BLOOD TYPES – 3 alleles a. A & B = both dominant b. O = recessive

BLOOD TYPE	ALLELES
A	AA or AO
B	BB or BO
AB	AB
O	OO

2. Cross a person with blood type O with a person who is pure for blood type B. What blood types will their children have?

	O	O
B	BO	BO
B	BO	BO

100% blood type B

V. SEX-LINKED TRAITS – gene for a trait carried ONLY by an X chromosome

1. Examples: colorblindness & hemophilia

2. XX = normal female
X'X = female carrier
X'X' = female with trait

XY = normal male
X'Y = male with trait
THERE ARE NO MALE CARRIERS!!!

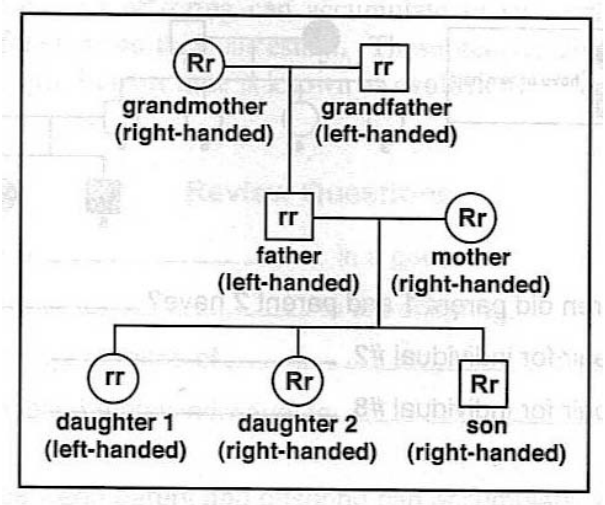
3. A man who is colorblind marries a woman who is a carrier. Will their kids be colorblind, carriers, or not possess the trait. Draw a Punnett square to show your work and give the phenotypes & percentages of their offspring.

	X^c	Y
X^c	$X^c X^c$	$X^c Y$
X	$X^c X$	XY

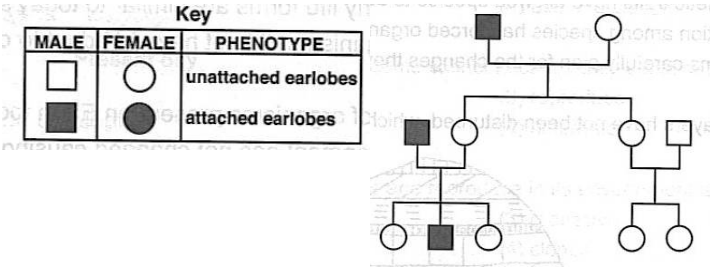
25% colorblind female
25% female carrier
25% normal male
25% colorblind male

VI. PEDIGREE CHARTS - trace a genetic trait in a family

1. Example:



2. The pedigree chart below traces the appearance of earlobes through 3 generations of a family.



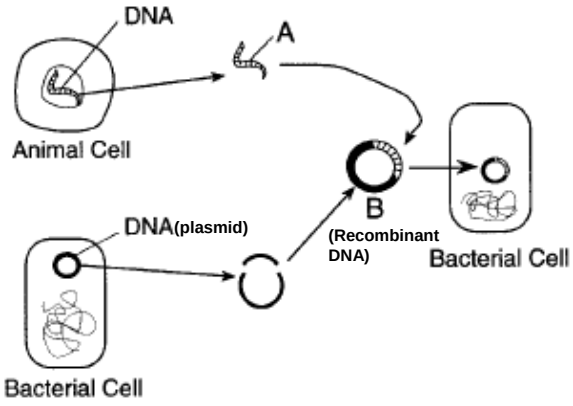
Based on the chart, attached

a. dominant trait
b. recessive trait
c. mutated trait
d. trait common in females

VII. APPLIED GENETICS

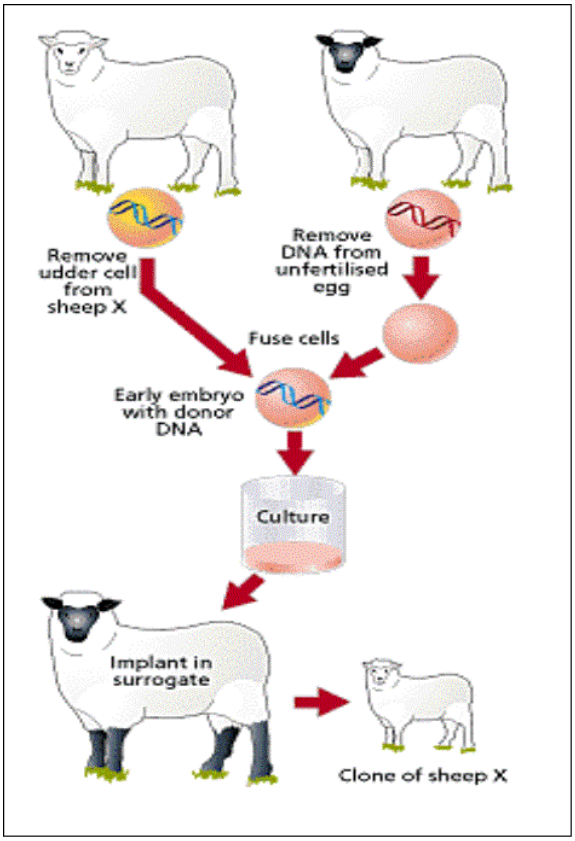
a. **GENETIC ENGINEERING -** the alteration of genes to get rid of undesirable traits or to produce desirable traits

Genetic Engineering



b. **SELECTIVE BREEDING** – breeding organisms with desirable traits
Example: a farmer choosing to grow only disease-resistant plants

c. **CLONING** – producing identical offspring (same genes)



REVIEW

1. In humans, a trait can be determined by one pair or many pairs of
(1) genes (2) microbes (3) cells (4) organs

2. Compared to the amount of hereditary information in a human body cell, how much hereditary information is contained in a human sex cell?
(1) one-quarter the amount (3) the same amount
(2) one-half the amount (4) twice the amount

3. Each body cell of a goldfish contains 94 chromosomes. How many chromosomes are contained in a goldfish sex cell?
(1) 23 (2) 47 (3) 94 (4) 188

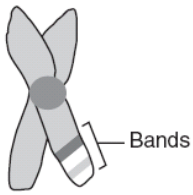
4. Many cells have a nucleus that contains chromosomes. These chromosomes carry genes that are composed of
(1) hormones (3) minerals and water
(2) DNA molecules (4) undigested food molecules

5. The vast variety of different traits found in humans results from
(1) intensive training and education
(2) sexual reproduction and mutations
(3) exercise and conditioning
(4) birth defects and recessive genes

6. Chromosome is to nucleus as DNA is to
(1) cytoplasm (2) gene (3) cell membrane (4) chloroplast

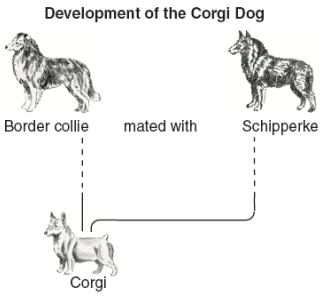
7. What is the function of DNA in a cell?
(1) regulating the movement of nutrients
(2) storing and releasing chemicals
(3) carrying genetic material
(4) providing energy for activities

8. The drawing below represents a pair of chromosomes. The area labeled "bands" shows ation of



(1) egg cells
(2) reproductive hormones
(3) sperm cells
(4) specific genes

9. The illustration below traces the development of the corgi dog over several generations as a result of human activity.



This is an example of the human activity called
(1) mutation
(2) selective breeding
(3) genetic engineering
(4) natural selection

Base your answers to questions 10 through 14 on the diagram below and on your knowledge of science. The diagram shows a model of human inheritance.

	A	*A*
a	*Aa*	*Aa*
a	*Aa*	*Aa*

Key
A = straight hairline (dominant)
a = peaked hairline (recessive)

10. The parent whose genes are *aa*
(1) must be dominant
(2) has a straight hairline
(3) has a peaked hairline
(4) may have *AA* offspring

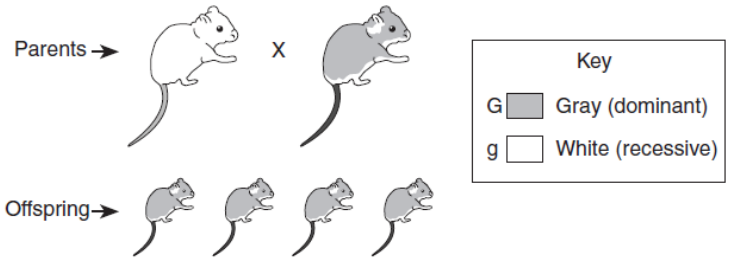
11. The diagram shown is called a
(1) Punnett square
(2) pedigree chart
(3) dichotomous key
(4) flowchart

12. What is this model used to determine?
(1) the possibility of having twins
(2) the probability of a trait being passed on
(3) the rate of mutation
(4) the production of sex cells

13. What is the genetic makeup of the parents?
(1) *AA* and *aa* (3) *AA* and *AA*
(2) *Aa* and *Aa* (4) *aa* and *aa*

14. Why will *Aa* individuals have a straight hairline rather than a peaked hairline?
(1) The peaked hairline occurs only in females.
(2) The peaked hairline is a mutation.
(3) The straight hairline is recessive.
(4) The straight hairline is dominant.

Base your answers to questions 15 and 16 on the diagram below. The diagram shows the offspring of a white mouse and a gray mouse. All of the offspring are gray.



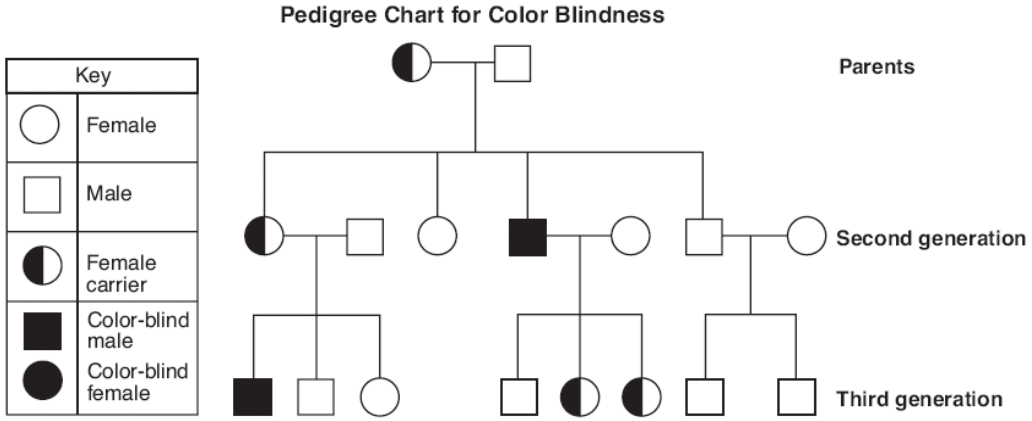
15. Which is a correct gene combination for the parents shown in the diagram?
(1) *GG* × *GG* (2) *gg* × *gg* (3) *gg* × *GG* (4) *Gg* × *Gg*

16. If two gray (*Gg*) mice mated, what percent of their offspring would have pure white fur?
(1) 25% (2) 50% (3) 75% (4) 100%

17. Base your answers following questions on the information and chart below and on your knowledge of science.

Inheritance of Color Blindness

Gender in humans is determined by a pair of sex chromosomes. A female has two X chromosomes and a male has one X and one Y chromosome. A recessive gene that causes color blindness is located on the X chromosome. When a male inherits this gene, he will be color-blind because the Y chromosome does not contain a gene for color blindness. In order for a female to be color-blind, she must inherit the recessive gene on both X chromosomes. If she has the gene on only one chromosome, she is *not* colorblind. She is called a carrier because she can pass this gene along to her offspring. The pedigree chart shows the children and grandchildren of a female carrier and a male who is *not* color-blind.



a. How many children did the original parents have? _____

b. What is the total number of children and grandchildren who are color-blind in this family?_____

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18. Pea plants can produce round or wrinkled peas. The genes for round and wrinkled peas are:

***R* = round (dominant)** ***r* = wrinkled (recessive)**

Complete the Punnett Square below, which shows a cross between a hybrid round-pea plant (*Rr*) and a wrinkled-pea plant (*rr*).

	R	*r*
r		
r		

---

19. The Punnet square below represents the result of the cross between two tall pea plants. All of the resulting offspring were tall.

	T	t
T	TT	Tt
T	TT	Tt

Key: T = tall height (dominant)
t = short height (recessive)

a. What percentage of the offspring will grow tall?

_____

b. According to the Punnett square, what is the probability of an offspring inheriting two tall genes? (Express your answer as a fraction or percentage.)

_____

c. Identify *two* offspring from the Punnet square that could produce short pea plants if they were crossed.

_____ _____

d. Explain your answer._____

e. Explain why both parent plants are tall, even though their genes for height are not exactly the same._____

_____

20. The Punnett square below shows an *RR* pea plant crossed with an *Rr* pea plant.

	R	*r*
R	*RR*	*Rr*
R	*RR*	*Rr*

Key

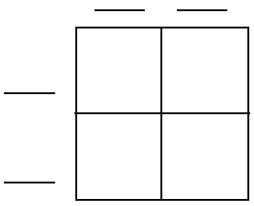
R = full, round pod shape (dominant)

r = wrinkled pod shape (recessive)

a. What percentage of the offspring will have a full, round pod shape?

_____

b. Complete the Punnett square provided below to show the crossing of two *Rr* parents.



c. If 100 offspring were produced from the crossing shown in the Punnett square below, approximately how many would have a wrinkled pod shape? [

	R	*r*
r	*Rr*	*rr*
r	*Rr*	*rr*

Key

R = full, round pod shape (dominant)

r = wrinkled pod shape (recessive)

_____

21. Base your answers to the following questions on the information below and on your knowledge of science.
In pea plants, the green-pod gene (*G*) is dominant over the yellow-pod gene (*g*).

a Two pea plants with green pods, *Gg* x *GG*, were crossed.
Complete the Punnett square below to show the results of this cross.

	G	*g*
G		
G		

b. What percentage of the offspring produced by this cross will most likely have green pods?

_____ **%**

c. Show the genetic makeup of two parent pea plants whose offspring would all have yellow pods.

_____ x _____

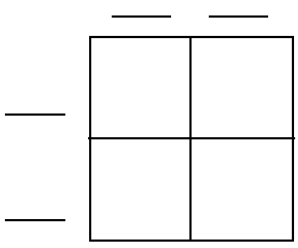
22. Base your answers to the following questions on the Punnett square and information below.

	T	T
t	Tt	Tt
t	Tt	Tt

In a certain plant, the gene for tall height (T) is dominant over the gene for short height (t). The Punnett square shows the results of a cross between a pure tall plant and a pure short plant.

a. What percentage of the offspring would be tall plants? _____

b. Use the Punnett square below to show the results of crossing two of the offspring shown in the Punnett square above.



c. Which process is represented by the use of the Punnett square?

(1) natural selection (3) sexual reproduction

(2) pollination (4)mutation

23. Base your answers to the following questions on the information about blood .

Human blood is classified into four blood types: A, B, AB, and O. An offspring's blood type is determined by genes passed on from the offspring's parents. Each parent gives an offspring one gene for blood type. The combination of the two genes determines the offspring's blood type. There are three genes, *A*, *B*, and *o*, that are responsible for the four blood types. The table below shows how these three genes interact to produce the four blood types.

Determination of Blood Type

Genes from Parents		Genes of Offspring	Blood Type of Offspring
Mother	Father		
A	*A*	*AA*	A
A	*o*	*Ao*	A
A	*B*	*AB*	AB
B	*B*	*BB*	B
o	*B*	*Bo*	B
o	*o*	*oo*	O

The Punnett square below shows the probability of blood types in the offspring of two parents. One parent's blood type genes are *AB* and the other parent's blood type genes are *Ao*.

	A	*B*
A	*AA*	*AB*
o	*Ao*	*Bo*

Based on this Punnett square, identify the expected percentage of offspring in each of the four blood types.

a. Blood type A: _____**%**

c. Blood type B: _____**%**

b. Blood type AB: _____**%**

d. Blood type O: _____**%**

e. Complete the Punnett square below, which shows a cross between two parents whose genes for blood type are *AB*.

	A	*B*
A		
B		

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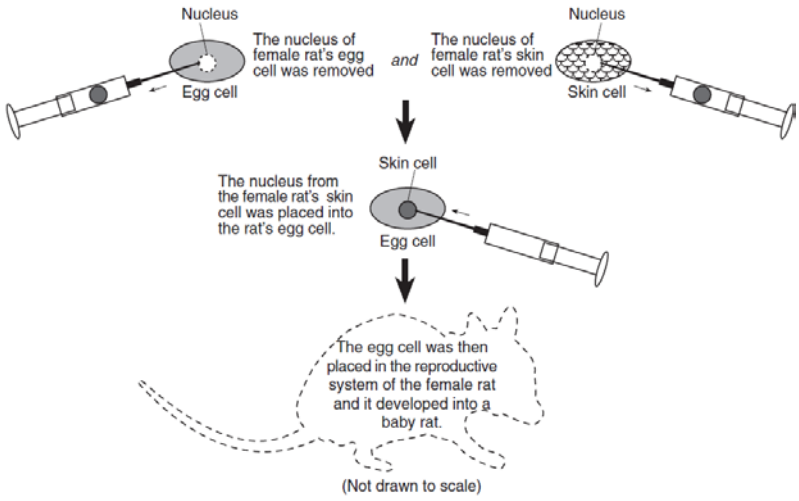
23. Base your answers to the following questions on the laboratory procedure described below and on your knowledge of science.



a. Explain why the baby rat was identical to its mother.

_____

_____

b. A different female laboratory rat gave birth to several babies after being fertilized with sperm. Explain why these babies will *not* be genetically identical to the mother.

_____

_____